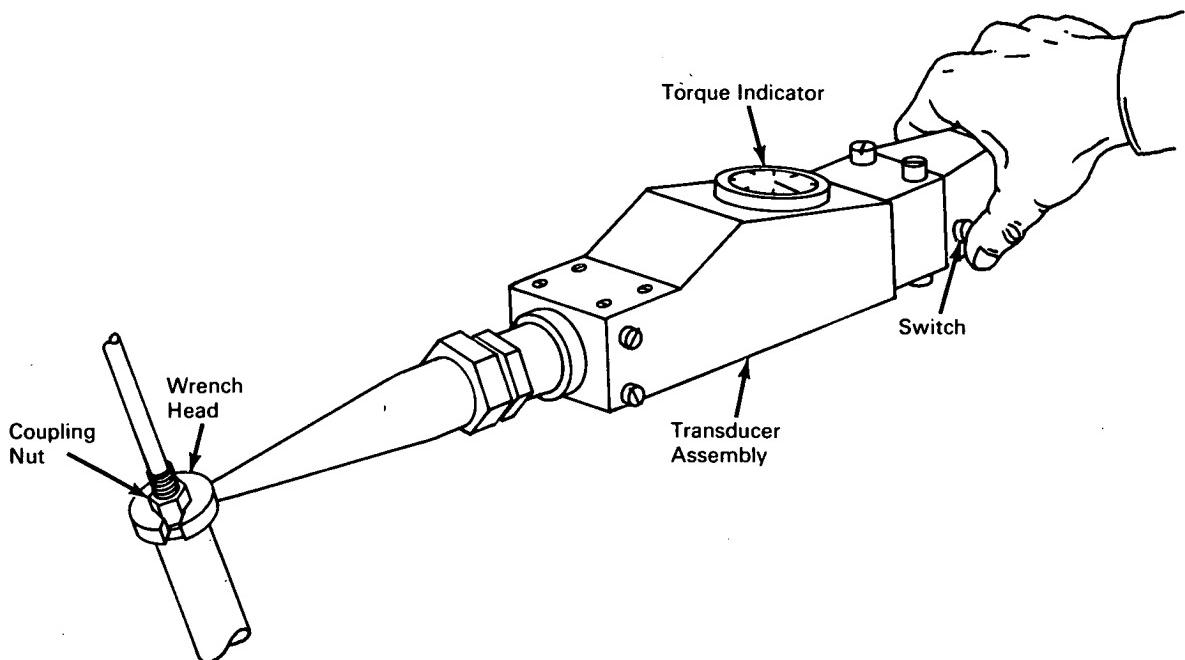


NASA TECH BRIEF



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Ultrasonic Wrench Produces Leaktight Connections



The problem:

To design a tool that will ensure a greater reliability of obtaining leaktight seals in flared tubing connections. In this type of connection, a seal is obtained by rotating a coupling nut to compress the tubing flare against the union bevel. A major portion of the torque applied by a wrench overcomes friction in the threads between the back shoulder of the nut and the face of the compression sleeve and between the sleeve and the tubing flare. These frictional forces vary from assembly to assembly and result in uncontrollable compression in the seal area when the connections are tightened to a specified torque with conventional wrenches.

The solution:

An ultrasonic wrench system which induces a flexural vibration mode in the nut. The system consists of a frequency converter, a junction box, and wrench assembly.

How it's done:

The frequency converter (a solid state circuit in a standard switch box) converts line power to 28 kHz, timed to provide 3-second output pulses. The junction box contains an impedance matching network, a transformer, an inductance coil, an overvoltage spark gap, a cooling-air regulator, and an air pressure gage. The wrench assembly incorporates a lead zirconate titanate transducer, which delivers from 70 to 85 percent of

(continued overleaf)

the high frequency electrical power into an acoustic load, and is provided with a standard dial indicator, calibrated in inch-pounds of torque. Acoustically designed 12-point, open-end wrench heads for each size fitting are mechanically interchangeable by means of a precision acoustical junction. The complete wrench assembly with a wrench head in place weighs approximately 11 pounds.

Use of the wrench assembly to tighten a flared tubing connection is shown in the illustration. The operator first tightens the coupling nut to the specified torque as observed on the dial indicator; he then depresses the thumb switch, exciting the transducer to the preset power level. During the fixed 3-second pulse application, the operator maintains the desired torque as the ultrasonic energy reduces friction and permits additional tightening of the nut to occur.

Notes:

1. This type of wrench should be useful in various operations requiring a reliable torquing tool.
2. Inquiries concerning this development may be directed to:

Technology Utilization Officer
Marshall Space Flight Center
Huntsville, Alabama 35812
Reference: B67-10353

Patent status:

Inquiries about obtaining rights for the commercial use of this invention may be made to NASA, Code GP, Washington, D.C. 20546.

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